Volume 1, Issue 2

Quarterly Brief

Legumes NEWS

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Editorial

Word from Head of Programme Legumes

As a program we work towards generating, developing and disseminating agricultural technologies for major legume crops in Uganda.

I officially write to you as the newly appointed Head of Legumes Program, NaCRRI and I look forward to working with all staff and our different partners to enable Legumes research grow exponentially. We appreciate Dr. Michael Ugen for the 13 years he steered this ship and wish him well in his new appointment as Director NaSARRI Serere.

Following the maiden Legumes News brief, this issue highlights the new 5 high iron and zinc varieties released in Uganda under the NAROBEAN name series. We try fighting global hunger and malnutrition with technologies such as these. We also bring you some insights from the promising drought lines that are under evaluation as we develop technologies that can help legumes adapt to severe climatic changes. Additionally, we share our headway in research on bean root rot evaluation experiments

You'll also find progress from the entomology area that recently held an inception meeting for the Bean Leaf Beetle project. From some of the field activities, the team received information from farmers on unorthodox ways of curbing the pest using human urine.

We trained farmers in general bean Agronomic practices and were able to produce over 33MTs of grain for the Precooked Beans factory, despite the severe effects of drought that nearly destroyed the crop in the last season of 2016A.

NARO Releases Five New Bean bio-fortified varieties in Uganda

By Dr. Stanley T. Nkalubo

According to the Uganda Demographic and Health report 2006, nearly 38% of Ugandan children below 5 years are stunted, 6% are wasted and 16% are underweight, which places Uganda among the few countries with the highest malnutrition rates. These persistent high rates of malnutrition in these children are symptomatic of the larger problems of inadequate access to food and suboptimal infant feeding practices leading to poor health. Malnutrition plays a major role in child morbidity and mortality and micronutrient deficiencies like iron and zinc are a major component with various health complications for expectant mothers and other adults.

As a way of remedying micronutrient malnutrition, the Uganda National Beans Program under the National Agricultural Research Organisation (NARO) in partnership with HarvestPlus, CIAT, USAID Feed the Future, developed, tested and released the first high iron and zinc bean varieties which include three bush and two climber growth types.

The development and eventual utilization of crops biofortified with increased levels of micronutrients would be one strategy

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to overcome malnutrition brought about by micronutrient deficiencies

During the development, a set of sixteen moderately high iron (≥70ppmg) and zinc (≥30 ppm) bean varieties of both bush and climber genotypes were evaluated in six agroecologies in Uganda including the central, southern, southwestern, east, northern and western regions.

The evaluation included assessing yield potential, ability to accumulate both iron and zinc micronutrient and farmers preferences for both production and organoleptic properties. After these evaluations, applications for variety release were made for five varieties that fulfilled all the test requirements. These included three bush (MORE 88002, RWR 2154 & RWR 2245) and two climber (MAC 44 & Nyiramuhondo) varieties. On 22nd July 2016 these varieties were released in Uganda under the NAROBEAN name series.

Considering that the common dry bean is the most important grain legume crop grown and consumed in Uganda, the new biofortified bean varieties are expected to provide a cheap source of micronutrient nourishment to the most vulnerable group which constitute of rural poor, improve their health and livelihood through the growing and consumption of these

NAROBEAN 5C (Climber, Large seeded)

Iron: 72.2-80ppm, Zinc: 34.7ppm

Yield potential: 2500-3300 kg/ha

Maturity:88-96 days

Best suited for mid-high altitude area

NAROBEAN 1 (Bush, Large seeded)

Iron: 65.8-72 ppm, Zinc: 31.4-34.2ppm

Yield potential:1500-2000 kg/ha

Maturity: 60-68 days

Best suited for low-mid altitude area

NAROBEAN 2 (Bush, Medium seeded)

Iron: 66.1-72 ppm, Zinc: 32.5-36.2ppm

Yield potential: 1600-2200 kg/ha

Maturity: 58-68 days

Best suited for low-mid altitude area

NAROBEAN 3 Bush, Medium seeded

Iron: 65.4-69ppm, Zinc: 35-38ppm

Yield potential: 1500-2000 kg/ha

Maturity: 58-68 days

Best suited for low-mid altitude area

NAROBEAN 4C (Climber, Large seeded)

Iron: 77.4-83ppm, Zinc: 32.1ppm

Yield potential: 2500-3700 kg/ha

Maturity: 82-88 days

Best suited for Mid-high altitude area

Journey towards promising DROUGHT tolerant Bean Varieties—Adaptive Trials

By Eunice Kesiime

The legumes programme carried out adoptive studies for five bean varieties that are less popular among farmers in 5 zonal agricultural research institutes. The ZARDIs in Abi Mukono, Buginyanya, Bulindi and Nabuin were supplied with NABE 4, NABE 15, NABE 16, NABE 18 and NABE 19.

Three of the research institutes set up demonstration plots of the released varieties. In addition, the institutes set up adoptive trials for candidate lines in the breeding pipeline for high iron and zinc, Moore 88002, RWR 2145 and RWR 2245, which were released in July.

Nabuin and Abi ZARDIs planted trials to evaluate 3 promising drought tolerant lines; SCN 1, SCN11 and SCR 26

LEGUMES PROGRAMME

Restoring resistance in released bean varieties and developing new genotypes with acceptable consumption and market qualities

Bean Leaf Beetle Project Inception in Uganda

By Samuel Olaboro

The Bean Leaf Beetle (BLB) Project was initiated in 2015 with the aim of mitigating the threat that bean leaf beetles (Ootheca species) poses to bean production in Uganda. With funding from the Bill and Melinda Gates Foundation, the project is implemented by the National Legumes Research Programme at the National Crops Resources Research Institute (NaCRRI) in Namulonge.

The central theme of the project is to investigate the bio-ecology of the bean leaf beetle with the aim of utilizing the knowledge generated in developing easily available diagnostic tools and readily adaptable and sustainable bean leaf beetle management practices.

The project inception took place on the 16th – 17th May 2016 at NaCRRI and was attended by Legumes staff, ZARDI technicians, district agriculture extension officers, members of academia and project team members from abroad with the Director of NaCRRI, Dr. Godfrey Asea as the Guest of honour.

The meeting was presided over by Dr. Michael Otim who welcomed all participants and invited Dr. Godfrey Asea who officially opened the meeting deliberations. Dr. Asea praised the project setup and remarked that it was unprecedented because it combined resources and personnel from various institutions and continents to carry out research towards a common goal. He challenged the rest of NaCRRI to take note and design future projects in a similar manner so as to enhance the reputation of the institute as a global centre of excellence for agriculture research.

Over the course of the two days, participants discussed; the project structure, students' proposals/research topics, the project milestones and the eventual mode of dissemination of the knowledge generated from the research conducted, to the various stakeholders involved directly and indirectly. Closure of the meeting was followed by visits to farmer fields in Lira District by project staff to showcase the bean leaf beetle on the bean crop and exhibit the student experimental trial to the delegation visiting from abroad.

The project team both locally based and from institutions abroad consists of; Dr. Michael Otim (Project P.I), Samuel Olaboro (Research Assistant), Charles Halerimana (Masters Student), Dalton Kanyesige (Masters Student), Prof. Peter Ellsworth (University of Arizona), Prof. Darren Kriticos (CSIRO, Australia), Prof. Robert Cheke (National Resources Institute, UK), Prof. John Colvin (National Resources Institute, UK) and Dr. Samuel Kyamanywa (Makerere University, Uganda).

The bean leaf beetle is a major pest of the common bean in Uganda particularly in Northern Uganda where it is known to cause up to 100% yield loss under severe infestation. Furthermore, its existence is being reported by farmers in areas where it was previously non-existent or had a low population such as South Western Uganda. This is particularly alarming due to the fact that the common bean accounts for 45% of dietary protein intake in Uganda and this pest is substantially reducing bean production in the country. Thus it is a straight forward conclusion that this pest poses a clear and present danger to food security and income generation in Uganda and also other African countries where it exists.

URINE: The Unorthodox Bean Leaf Beetle Control Practice

By Samuel Olaboro

A farmer in Amuria district uses human urine to control the bean leaf beetle and other pests as well. Every morning each family member is expected to deposit his/her urine into a container and this is stored in a secluded cool location where the urine is allowed to ferment for about 2 weeks to a month so that it loses its recognizable smell and prevent it from *'causing corrosion of the plants'*. He then dilutes the urine with water and applies it during the pre-flowering to podding period (when insect population is high by sprinkling the urine onto the plants from the container (since no one was willing to lend him a sprayer). He is very affirmative and asserts that it is very effective in controlling pests.

For any researcher, it is always refreshing to get the farmers' perspectives on how they deal with the universal problem of insect pests in the garden. The observations, ideas and innovations range from the routine to insightful and at times simply outrageous and they vehemently declare that these practices work effectively.

The BLB project conducted surveys on the pest distribution,

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impact and population dynamics in the agro-ecological zones of the Northern moist farmlands and the Kyoga basin respectively. During the interactions with farmers, a series of answers were given for how they control the said pest.

Farmers mentioned that during the pre-flowering period, they released their chicken into the gardens to predate the bean leaf beetles and other insect pests as well. This was quite effective since chicken are voracious insectivores and quickly bring down the insect populations. However, the shortfalls of this approach is that once flowers emerge, the chicken start feeding on the flowers as well so the farmers have to restrain them or chase them away from the gardens for the duration of the flowering period.

Farmers also mentioned the use of ash to repel the beetles. They simply sprinkle the ash on the bean plants in the gardens and the hypothesis is that this forms a layer on the leaf surface that acts as a physical barrier against the bean leaf beetles. The extent of the effectiveness of this method is still in question and hence there is potential for research particularly to assess if the control is simply physical or if a chemical component is involved as well.

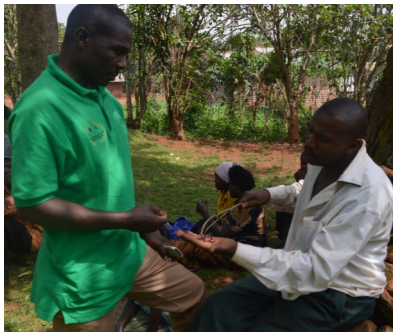
Lastly some farmers said that regular weeding also goes some way into controlling the beetle populations in their gardens. This needs further investigation because it contradicts with existing theories such as Finch and Collier's theory which asserts that insects tend to land more often in areas with less vegetative cover since the host plants are prominently seen by the pests while in areas with high vegetation cover the host plants are physically obstructed or visually hidden by other plants from the pests.

In conclusion, farmers offer useful insights and invaluable components that researchers can borrow and examine since they (farmers) are not bound by limitations like cliché modern science procedures that tend to limit simple and easily applicable innovations. ***(Images sourced online)***

Precooked bean project: Enrolling farmers for grain production

By Paul Aseete

Launched in October 2014, the precooked bean project promised to benefit bean farmers through strengthening their capacity to produce and market bean grain. As one of the key actors in the bean value chain, farmers are poised as the greatest beneficiaries from the project.



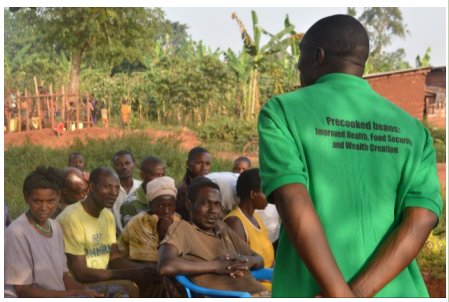
The Legumes programme, before supplying seed, trained the grain farmers in Mubende, Mityana and Kiboga districts before the Season 2016A. Though the season was poor due to the prolonged drought, farmers say the skills they got from training - timely planting, pest and disease management practices, use of fertilizers and proper weed management - helped them greatly.

As part of its contribution in creating sustainable supply systems, the legumes programme in collaboration with Community enterprises development Organization (CEDO) supplied 4.36 tons of bean seed of NABE 4, NABE 14, RWR 2154, NABE 6 and NABE 17 to farmers. The seed was supplied to 12 farmer groups with 168 farmers who were able to produce 33.1 tons of grain worth UGX 66.124 Million. This is the ***collective action model*** that the project is testing to ensure sustained supply of the raw material for the precooked bean processing factory.

From the above model, farmers receive and plant beans individually and aggregate them during the time for marketing. While using the ***seed credit model*** (also under testing by the project), seed is supplied on credit and the farmers pay after harvest. To ensure enforceability of repayment, the group signs a contract on behalf of the individual farmers upon receiving seed. This collective responsibility encourages farmers to work hard for the benefit of the entire group which minimizes defaults.

While farmers exhibited enthusiasm and the will to work together, more effort is required to strengthen the aggregation system. Farmers will establish standard collection points to hold their produce in the bulking process before it's bought by the processor. Selected farmer residences are used as temporary holding grounds currently.

In the next season, the project will train farmers on how to strengthen their groups for collective action, how to pre-process beans for better quality, promoting group saving and credit to minimize grey selling and how to build trust within groups. These trainings aim at promoting better market engagements for farmers' produce.



ROOT ROT GERMPLASM EVALUATION EXPERIMENTS

SOUTHERN BLIGHT (*Sclerotium rolfsii Sacc)*

By Justine Nakibuule

Sclerotium root rot is one of the commonest bean diseases affecting bean yields in Uganda. The introduction of resistant varieties is so far the only reliable means of curbing this disease but unfortunately to date, there is no known source of resistance to *Sclerotium rolfsii* in common bean (*Phaseolus vulgaris*).

In the struggle to find a probable source of resistance, we did several random screening experiments on the available germplasm from different origins. These screen house experiments are aimed at screening germplasm for resistance or tolerance to sclerotium root rot caused by *sclerotium rolfsii* so as to identify new source of resistance to the pathogen.

During screening, different germplasm lines are sowed in planting trays by planting 16 seeds per variety in a tray. The experiments are always replicated thrice making a total of 48 seeds of a particular variety in one experiment. In each of the planting trays, 5 varieties are planted 4 of them being germplasm lines and the 5th is a susceptible check for root rot CAL 96. Each planting tray consists of a total of 10 seed rows where each of the planted varieties shares two rows (16 seeds).

Evaluations commence as early as 14 days after sowing (DAS) with **germination data** to record how many seeds germinated out of the 48 seeds planted per variety. At 28 DAS, **disease incidence and severity data** is also taken to access how the different varieties considered in that experiment have reacted to *sclerotium rolfsii Sacc* Pathogen following a 1-5 scale.

The earlier work was carried out on different ADP lines (Andean Diversity Panel) and ALB lines, these are to date some of the well performing lines

A section of on- going evaluation experiments in the legumes screen house

Table 1: Reaction of some selected bean lines to *S.rolfsii*

Bean line	% Germination	% Disease incidence	Severity (1-5)
ADP 54	94	67	3.1
ADP 58	94	76	2.8
ADP 658	97	55	3.1
ALB 123	79	42	2.3
ALB 146	91	68	3
ALB 2	77	43	2.4
ALB 9	73	57	2.6
ALB 94	69	30	1.7

- percentage germination was based on a total of 48 seeds planted in all the 3 reps
- disease incidence and severity was done on only germinated seeds
- the severity score is a standard 1-5 scale i.e.

1 - No disease
2 - Disease symptoms but no visible fungal outgrowths
3 - Disease symptoms with visible fungal outgrowths (mycelia and/ or sclerotia)
4 - Partial wilting of plant
5 - Complete wilting and death of plant.

Pictorial presentation of scores

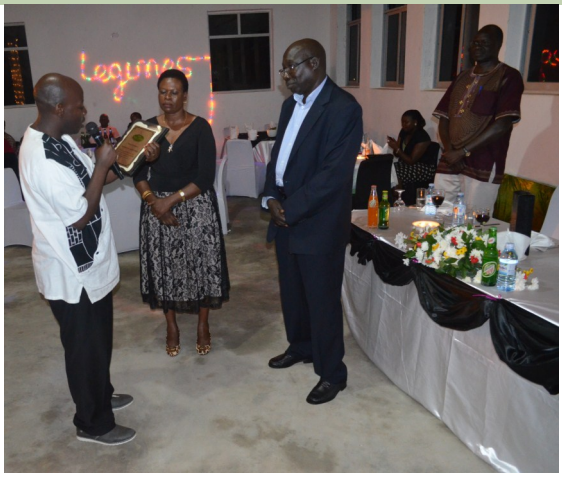
More screening has been done and is still on going and out of the recently screened lines the following have proven to be promising sources of resistance.

KWP 9
KWP 17
KWP 12

These are however still under study with some repeated experiments of the above lines still running in the screen house

pictorial representation of the root system of the promising lines.

Legumes Programme welcomes Dr Stanley T. Nkalubo as new Team Leader; Bids Dr Ugen Farewell



The Financial Year 2016/17 ushered in a number of new leaders at NaCRRI one of whom is the Team Leader Legumes Programme.

Dr Stanley T. Nkalubo served as acting Head of Programme for FY2015/16 and was later appointed Team Leader Legumes.

He succeeds Dr Michael A. Ugen who has lead the Legumes programme since 1999. The Programme advanced and grew tremendously under his leadership. Staff appreciated his time of leadership at the July farewell party in Kampala and wished him the best as the Director of NaSARRI in Serere.

Legumes staff pledged continuous support to Dr Nkalubo so as to keep flying the Legumes flag higher and make excellent progress together as is the practice.

The Agricultural and Trade Show: An Illustrated Forum For Technology Transfer

By W. Ssekandi, A. Nantongo, and F. Nakkazi

Annually, the Uganda National Farmers Federation organizes an Agricultural and trade show at the source of the Nile show grounds. This year's event marked the 24th edition held between 11th and 17th July. This event was an avenue for people from different worlds to converge and share experiences on how sustainable agriculture that adapts to climatic changes.

The Show was officially opened by the President of the Republic of Uganda, His Excellency Yoweri Kaguta Museveni who showed special interest in cassava farming and the UBIC stall in light of the pending Bill on Biotechnology and GMOs.

The Legumes programme, as a usual participant, exhibited legume agricultural technologies, value added bean products and information material through researcher-farmer interface. Legumes programme set up technology demonstration plots with 10 bean varieties including the 5 recently released high iron and zinc varieties that captured stall visitors' attention.

The most persistent question from several stakeholders was how to access the seeds especially of the latter varieties. The challenge is to get all the varieties to the grassroots as most private seed sector dealers concentrate on a few earlier released bush varieties and rarely deal with climbers.

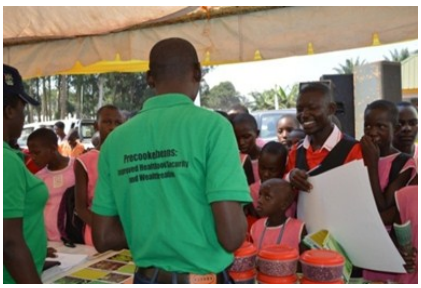
There is need for a different approach to get climbing bean seed varieties to farmers.

In addition, the severe drought in season 2016A was mentioned as a major constraint and farmers asked for drought tolerant bean varieties that they could opt for in order to ensure food security. This was a great concern from farmer in the North East and Northern region who were urged to take up farming of NABE 15 and NABE 18 that are more tolerant to extreme dry weather as we await drought candidate lines.

Bean pests and diseases are major bean production constraints and serious challenges to various stakeholders in the Agricultural sector. To this effect, information was availed to the public in form of brochures of bean production and posters on management of bean diseases. These were in different local languages which enabled a wider reach and the initiative was applauded by the different stakeholders. There was also a lot of direct researcher-farmer interaction.

We also showcased locally made bean value added products namely, cupcakes, daddies, cookies, bagia, salted bean snack and flour which were a wonder to the public especially those with business interest. The products were made using short and inexpensive procedures and many received brief explanations on how to make the flour and incorporate bean content in confectionery.

The show enables researchers receive feedback on several released technologies and crop commodities which results into improvement of approaches of dissemination. Through this event, there was massive public awareness, promotion of technologies to achieve food security and mitigate malnutrition and poverty across different categories of men and women .



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